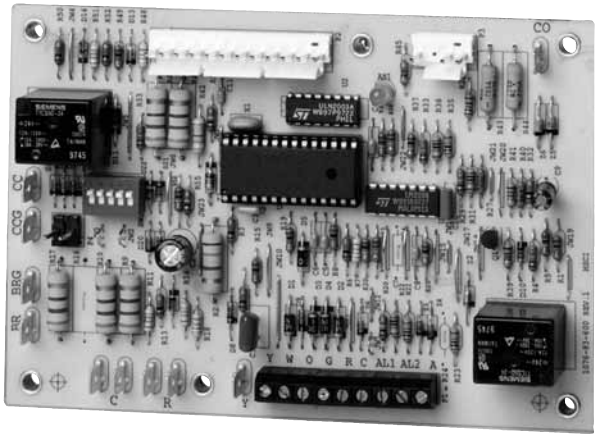
CXM CONTROLS



CXM Digital
Heat Pump Controller

Application, Operation & Maintenance

97B0003N12
Rev.: 03 January, 2011

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CXM Electronic Controls Features Comparison

Basic Features	CXM	CXM-Lon	CXM-MPC
High and Low Refrigerant Pressure Protection	S	S	S
Water Coil Low Temperature Cutout	S	S	S
True 24VA Thermostat Signals	S	S	S
Thermostat Inputs Compatible with Triacs	S†	S†	S†
Condensate Overflow Sensor	S	S	S
Anti-Short-Cyle Time Delay	S	S	S
Random Start	S	S	S
Alarm (selectable dry contact or 24VA)	S	S	S
Water Valve Relay	S	S	S
Water Valve Relay with Compressor Delay	N/A	N/A	N/A
Emergency Shutdown	N/A	DDC	DDC
Night Setback with Override	N/A	DDC	DDC
Outdoor Air Damper Control	N/A	N/A	N/A
Advanced Features			
Intelligent Reset	S	S	S
High and Low Voltage Protection	S	S	S
Air Coil Low Temperature Cutout	S	S	S
Low Temperature Setpoint Field Select (water, antifreeze)	S	S	S
Electric Heat Control Outputs	S	S	S
Boilerless Electric Heat Control	N/A	N/A	N/A
Intelligent Reversing Valve Operation	N/A	DDC	DDC
High/Low Fan Speed Outputs	N/A	N/A	N/A
Intelligent Fan Speed Control	N/A	N/A	N/A
Thermostat Type Select (Y,O or Y,W)	N/A	N/A	N/A
Reversing Valve Signal Select (O or B)	N/A	N/A	N/A
Dehumidistat Input	N/A	N/A	N/A
Reheat Dehumidification Control*	N/A	N/A	N/A
Multiple Units on One Thermostat/Wall Sensor	N/A	DDC	DDC
Service and Reliability Features			
Service Test Mode	S	S	S
LED Fault and Status Lights	S	S	S
Fault Memory after Reset	S	S	S
Unit Performance Sentinel	S	S	S
Harness-Type Factory Wiring Connections	S	S	S
Fully Noise-Tested Design	S	S	S
CE Approval	S	S	S
Removable Low Voltage Connector	N/A	N/A	N/A
DDC / Energy Management Features			
Echelon LonMark Compliant	N/A	S	N/A
BACNET Compliant	N/A	N/A	S
Johnson N2 Compliant	N/A	N/A	S
Modbus Compliant	N/A	N/A	S
Leaving Air and Water Temperature Sensor	N/A	S	S
Digital Wall Sensor	N/A	O	O

S = Standard O = Optional DDC = Feature can be provided by DDC System
CXM-Lon = CXM with LonMark Module CXM-MPC = CXM with MPC Module

* = Check with your Factory Representative for model availability MPC = Multiple ProtoCol (BACNET, N2, Modbus)

† = Compatible with our thermostats. For customer supplied thermostat, check with Controls Engineering Department for approval.

CXM Unit Control

Rev.: 03 January, 2011

CXM Electronic Heat Pump Control

CXM Overview
The CXM electronic control is a microprocessor based heat pump controller that is simple to use, yet provides all the necessary features to improve the operation and safety of water source heat pumps.

CXM Controller Part Number:
17B0001N01 CXM Control Board

General Operating Parameters

The following are general operating parameters for the CXM control:
- Operating Environment: -40°F to 176°F and up to 95% relative humidity, non-condensing.
- Storage Environment: -40°F to 185°F and up to 95% relative humidity, non-condensing.

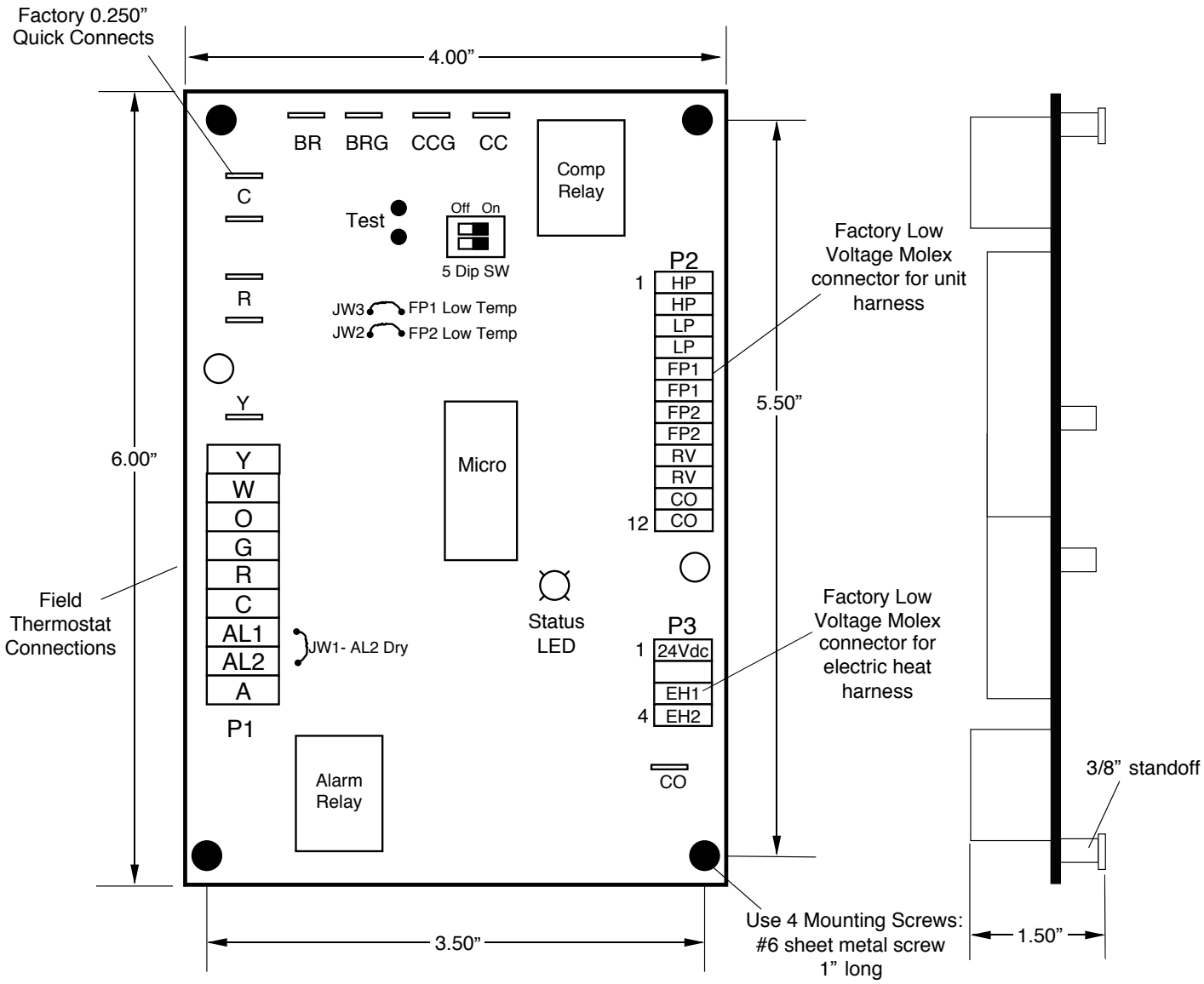
Power Requirements:
- CXM only power draw -
- Normally 5 VA draw at 24VAC.
- Maximum 9 VA draw at 24VAC.
- A dedicated 24VAC, 50-60Hz, 1Ph, 40VA transformer minimum is required for typical WSHP application.

Relay Contact Ratings
The following relays are mounted on the CXM control:
- Compressor Relay: 40VA at 24VAC.
- Alarm Relay: 28VA at 24VAC.

Grounding
The control board is grounded through two of the metal standoffs.
Field connection ratings for the CXM control:
'A' terminal: 20VA at 24VAC.

Product Specification Features
- Anti-short cycle protection
- High and low pressure cutouts
- Water coil low temperature cut-out
- Air coil low temperature cut-out
- Random start
- Unit Performance Sentinel
- Over/under voltage protection
- Diagnostic LED
- Reset lockout at unit or disconnect
- Intelligent reset
- Condensate overflow sensor
- Test Mode
- Electric heat outputs
- Accessory water valve connection

CXM Physical Dimensions & Layout



CXM Controls

Field Selectable Inputs

Test Mode - Test Mode allows the service personnel to check the operation of the control in a timely manner. By momentarily shorting the test terminals, the CXM control enters a 20 minute Test Mode period in which all time delays are sped up 15 times. Upon entering Test Mode, the Status LED will flash a code representing the last fault. For diagnostic ease at the thermostat, the Alarm Relay will also cycle during Test Mode. The Alarm Relay will cycle on and off similar to the status LED to indicate a code representing the last fault, at the thermostat.

Note: Code 1 indicates there is no fault in memory; stated differently, the control has not faulted since the last power-down to power-up sequence.

Test Mode can be exited by shorting the test terminals for 3 seconds.Test Mode can also be entered and exited by cycling the G input, 3 times within a 60 second time period.
During Test Mode, the control monitors to see if the FP1 and FP2 thermistors are in the appropriate place. If the control is in Test Mode, the control will lockout with Code 9 after 30 seconds if:
the compressor is On in Cooling Mode and the FP1 sensor is colder than the FP2 sensor, or,
the compressor is On in Heating Mode and the FP2 sensor is colder than the FP1 sensor.

Table 1: LED & Alarm Relay Operations

Description of Operation	LED	Alarm
Normal Mode	ON	Open
Normal Mode w/UPS Warning	ON	Cycle (Closed 5 seconds, Open 25 seconds)
CXM is non-functional	OFF	Open
Fault Retry	Slow Flash	Open
Lockout	Fast Flash	Closed
Over/Under Voltage Shutdown	Slow Flash	Open (Closed after 15 Minutes)
Test Mode - No Fault in Memory	Flashing Code 1	Cycling Code 1
Test Mode - HP Fault in Memory	Flashing Code 2	Cycling Code 2
Test Mode - LP Fault in Memory	Flashing Code 3	Cycling Code 3
Test Mode - FP1 Fault in Memory	Flashing Code 4	Cycling Code 4
Test Mode - FP2 Fault in Memory	Flashing Code 5	Cycling Code 5
Test Mode - CO Fault in Memory	Flashing Code 6	Cycling Code 6
Test Mode - Over/Under Shutdown in Memory	Flashing Code 7	Cycling Code 7
Test Mode - UPS in Memory	Flashing Code 8	Cycling Code 8
Test Mode - Swapped Thermistor	Flashing Code 9	Cycling Code 9

Special Notes and Examples:
- Slow Flash = 1 flash every 2 seconds
- Fast Flash = 2 flashes every 1 second
- Flash code 2 = 2 quick flashes, 10 sec. pause, 2 quick flashes, 10 sec. pause, etc.
- On pulse 1/3 sec.; off pulse 1/3 sec.

Retry Mode - If the control is attempting a retry of a fault, the status LED will slow flash (slow flash = one flash every 2 seconds) to indicate the control is in process of retrying.

Note: In the following field configuration options, jumper wires should be clipped ONLY when power is removed from the CXM control.

Water Coil Low Temperature Cut-Out Limit Setting - Jumper 3 (JW3-FP1 Low Temp) provides field selection of temperature limit setting for FP1 to be 30°F or 10°F.

Not Clipped = 30°F. Clipped = 10°F.

Air Coil Low Temperature Cut-Out Limit Setting - Jumper 2 (JW2-FP2 Low Temp) provides field selection of temperature limit setting for FP2 to be 30°F or 10°F.

Not Clipped = 30°F. Clipped = 10°F.

Alarm Relay Setting - Jumper 1 (JW1-AL2 Dry) provides field selection of Alarm Relay terminal AL2 to be jumpered to 24VAC or to be dry (no connection).
Not Clipped = AL2 connected to R. Clipped = AL2 dry contacts (no connection).

DIP Switches

Note: In the following field configuration options, DIP switches should only be moved when power is removed from the CXM control, to ensure proper operation.

DIP Switch 1: Unit Performance Sentinel Disable - provides field selection to disable the UPS feature.
On = Enabled. Off = Disabled.

DIP Switch 2: Stage 2 Selection - provides selection of whether the compressor has an on delay. If set to stage 2, the compressor will have a 3 second delay before energizing. Also, if set for stage 2, the Alarm Relay will NOT cycle during Test Mode.
On = Stage 1. Off = Stage 2

DIP Switch 3: - Not Used.

DIP Switch 4: DDC Output at EH2 - provides selection for DDC operation. If set to DDC Output at EH2, the EH2 terminal will continuously output the last fault code of the controller. If set to EH2 Normal, then the EH2 will operate as standard electric heat output.

On = EH2 Normal. Off = DDC Output at EH2.

NOTE: Some CXM controls only have a 2 position DIP switch package. If this is the case, then this option can be selected by clipping the jumper which is in position 4 of SW1:

Jumper not clipped = EH2 Normal. Jumper clipped = DDC Output at EH2.

DIP Switch 5: Factory Setting - Normal position is ON. Do not change selection unless instructed to do so by the Factory.

Safety Features
The following safety features are provided to protect the compressor, heat exchangers, wiring and other components from damage caused by operation outside of design conditions.

Anti-Short Cycle Protection - The control features a 5 minute anti-short cycle protection for the compressor. **Note: The 5 minute anti-short cycle also occurs at power up**.

Random Start - The control features a 5-80 second random start upon power up.

Extended Compressor Operation Monitoring - If the compressor relay has been on for 4 continuous hours, then the control will automatically turn off the compressor relay and wait the short cycle protection time. All appropriate safeties including the LP will be monitored during the off time. If all operation is normal, and if the compressor demand is still present, the control will turn the compressor back on.

Fault Retry - In Fault Retry Mode, the Status LED begins slow flashing to signal that the control is trying to recover from a fault input. The CXM control will stage off the outputs and then "try again" to satisfy the thermostat "Y" input call. Once the thermostat input calls are satisfied, the control will continue on as if no fault occurred. If 3 consecutive faults occur without satisfying the thermostat "Y" input call, then the control will go into Lockout Mode. The last fault causing the lockout will be stored in memory and can be viewed by going into Test Mode.
Note: If "1 Try" is selected for FP1 and FP2, then there will be no "retries" for FP1 and FP2 faults. The control will only try one time for these faults.

Lockout - In Lockout Mode, the Status LED will begin fast flashing. The compressor relay is turned off immediately.

⚠ CAUTION! ⚠

CAUTION! Do not restart units without inspection and remedy of faulting condition. Equipment damage may occur.

Lockout Mode can be soft reset via the thermostat "Y" input or can be hard reset via the disconnect. The last fault causing the lockout will be stored in memory and can be viewed by going into Test Mode.

Lockout with Emergency Heat - While in Lockout Mode, if W becomes active, then Emergency Heat Mode will occur.

High Pressure Switch - When the high pressure switch opens due to high refrigerant pressures, the compressor relay is de-energized immediately since the high pressure switch is in series with the compressor contactor coil. The High Pressure Fault recognition is immediate as well.

High Pressure Lockout Code = 2
Example: 2 quick flashes, 10 sec. pause, 2 quick flashes, 10 sec. pause, etc.

Low Pressure Switch - The low pressure switch must be open and remain open for 30 continuous seconds during ON cycle to be recognized as a Low Pressure fault. If the low pressure switch is open for 30 seconds prior to compressor power up it will be considered a low pressure (loss of charge) fault. The low pressure switch input is bypassed for the initial 120 seconds of a compressor run cycle.

Low Pressure Lockout Code = 3

Water Coil Low Temperature Cut-Out Limit (FP1) - The control will recognize an FP1 fault, during a compressor run cycle if:
a) the thermistor temperature is below the selected low temperature protection limit setting, and,
b) the thermistor temperature is rising (getting warmer) at a rate LESS than 2°F per 30 second time period. The FP1 input is bypassed for the initial 120 seconds of a compressor run cycle.

FP1 Lockout Code = 4

Air Coil Low Temperature Cut-Out Limit (FP2) - The control will recognize an FP2 fault, during a compressor run cycle if:

a) the thermistor temperature is below the selected low temperature protection limit setting, AND
b) the thermistor temperature is rising (getting warmer) at a rate LESS than 2F per 30 second time period.

The FP2 input is bypassed for the initial 120 seconds of a compressor run cycle.

FP2 Lockout Code = 5

Condensate Overflow - The Condensate Overflow sensor must sense overflow levels for 30 continuous seconds to be recognized as a CO fault. Condensate Overflow will be monitored during compressor run cycle.

CO Lockout Code = 6

Over/Under Voltage Shutdown - An Over/Under Voltage condition exists when the control voltage is outside the range of 18VAC to 31.5VAC. Over/Under Voltage Shutdown is self resetting in that if the voltage comes back within range of 18.5VAC to 31VAC for at least 0.5 seconds, then normal operation is restored. This is not considered a fault or lockout. If the CXM is in Over/Under Voltage Shutdown for 15 minutes, the Alarm Relay will close.

Over/Under Voltage Shutdown Code = 7

Unit Performance Sentinel - UPS (patent pending) - The UPS feature warns when the heat pump is operating inefficiently. A UPS condition exists when:

a) in Heating Mode with compressor energized, if FP2 is greater than 125°F for 30 continuous seconds, or
b) in Cooling Mode with compressor energized, if FP1 is greater than 125°F for 30 continuous seconds, OR FP2 is less than 40°F for 30 continuous seconds.

If a UPS condition occurs, the control will immediately go to UPS warning. The status LED will remain on as if the control is in Normal Mode. (see "LED and Alarm Relay Operation Table"). Outputs of the control, excluding LED and Alarm Relay, will NOT be affected by UPS. The UPS condition cannot occur during a compressor off cycle. During UPS warning, the Alarm Relay will cycle on and off. The cycle rate will be On for 5 seconds, Off for 25 seconds, On for 5 seconds, Off for 25 seconds, etc.

Unit Performance Sentinel Warning Code = 8

Swapped FP1/FP2 Thermistors - During Test Mode, the control monitors to see if the FP1 and FP2 thermistors are in the appropriate place. If the control is in Test Mode, the control will lockout, with Code 9, after 30 seconds if:

a) the compressor is On in Cooling Mode and the FP1 sensor is colder than the FP2 sensor. Or,
b) the compressor is On in Heating Mode and the FP2 sensor is colder than the FP1 sensor.

Swapped FP1/FP2 Thermistor Code = 9.

Diagnostic Features - The Status LED on the CXM control advises the serviceman of the current status of the CXM control. The status LED can display either the current CXM Mode or the last fault memory if in Test Mode. See Table 1 for a complete listing of codes. If the fault type is "Primary" (HP, LP, FP1, FP2, or CO) then the fault type will always be retained in memory (Primary faults will overwrite Secondary faults). If the fault type is "Secondary" (Over/Under Voltage, UPS or Swapped FP1/FP2) then the fault type will only be retained if there are no "Primary" faults in memory. The Secondary fault types will not "overwrite" the Primary fault memory.

Unit Operation Description

PowerUp - The unit will not operate until all the inputs and safety controls are checked for normal conditions. **Note: The compressor will have a 5 minute anti-short cycle delay at power-up.**

Standby - In Standby Mode, Y and W inputs are not active. Inputs O and G may be active. Compressor will be off.

Cooling - To enter Cooling Mode, Y and O become active. The first time after power-up that there is a call for compressor, the compressor will follow a 5 to 80 second random start delay. There will also be a 5 minute compressor anti-short cycle protection time as well. After the random start delay and the anti-short cycle delay, the compressor relay is energized. On all subsequent compressor calls, the random start delay is omitted.

Heating Stage 1 - To enter Heating Stage 1 Mode, Y becomes active. The first time after power-up that there is a call for compressor, the compressor will follow a 5 to 80 second random start delay. There will also be a 5 minute compressor anti-short cycle protection time as well. After the random start delay and the anti-short cycle delay, the compressor relay is energized. On all subsequent compressor calls, the random start delay is omitted.

Heating Stage 2 - To enter Heating Stage 2 Mode, W becomes active (Y already active). The G input must be active or the W input is ignored. The compressor relay remains on. EH1 is turned on immediately. With continuing Heating Stage 2 demand, EH2 will turn on after 10 minutes. The EH2 will not turn on (or will turn off if already on) if FP1 temperature is greater than 45°F and FP2 is greater than 110°F.

Emergency Heat - In Emergency Heat Mode, W becomes active while Y is not active. The G input must be active or the W input is ignored. EH1 is turned on immediately. With continuing Emergency Heat demand, EH2 will turn on after 5 minutes. The FP1 and FP2 temperatures do not effect emergency heat operation.

Table 1a: Fault Description Table

Fault	Fault LED Code	Fault Condition
No Fault in Memory	1	There has been no fault detected since the last power down/power up sequence
High Pressure Switch	2	HP Open Instantly
Low Pressure Switch or LOC	3	LP open for 30 continuous seconds before or during a call (bypassed for first 120 seconds)
Low Temperature Cut-Out Coax - FP1	4	FP1 below Temp limit for 30 continuous seconds (bypassed for first 120 seconds of operation)
Low Temperature Cut-Out Aircoil - FP2	5	FP2 below Temp limit for 30 continuous seconds (bypassed for first 120 seconds of operation)
Condensate Overflow	6	Sense overflow (grounded) for 30 continuous seconds
Over/Under Voltage Shutdown	7 (Autoreset)	"R" power supply is <18VAC or >31.5VAC
UPS Warning	8	Unit Performance Warning signal has occurred
Swapped FP1/FP2	9	FP1 and FP2 are in reversed positions

ENGINEERING GUIDE SPECIFICATIONS

The following engineering guide specifications for the CXM control should be a part of all product submittals.

CXM Control

A microprocessor-based compressor controller (CXM) shall be provided to monitor and control unit operation. The control shall provide compressor and electric heater sequencing, high and low pressure monitoring, field selectable water and air coil low temperature cut-out sensing, condensate overflow sensing, over/under voltage monitoring, and unit performance sentinel. The control shall also provide for water valve connection, a Test Mode, short cycle protection, random start-up, as well as fault LED, fault memory, and intelligent fault retry. The control shall employ a quick attach harness assembly for low voltage connections to the CXM control board to aid in troubleshooting or replacement. An integral terminal block with screw terminals shall be provided on the CXM control for all field low voltage connections.

CXM Service & Application Notes

CXM Sensors

Pressure Switches
All pressure switches are designed to be normally closed during normal operating conditions, and to open upon fault.

Condensate Sensor
The Condensate Sensor input will fault upon sensing impedance less than 100,000 Ohms for 30 continuous seconds. The recommended design uses a single wire terminated with a male 1/4" quick connect located in the drain pan at desired trip level. Upon a high condensate level the water will short between the air coil and the quick connect producing a resistance less than 100,000 Ohms. Since condensate is free of impurities, it has no conductivity. Only the impurities from the drain pan and coil dust or dirt create the conductance. A second ground wire with appropriate terminal to the drain pan can be used with the control to replace the air coil ground path. The Condensate Sensor can also essentially be any open contact that closes upon a fault condition.

Thermistor Temperature Sensors
The thermistor is available in the following configurations shown in Table 2. The thermistor is an NTC (negative temperature coefficient) type. The sensor has a 1% tolerance and follows the Table 2 and Chart 2 shown. Table 4 shows the nominal resistance at any given temperature and can be used for field service reference. The sensor will use a minimum of 24 awg wire and be epoxy embedded in the beryllium copper clip.

Table 2: 1% Sensor Calibration Points

Temp (°F)	Minimum Resistance (Ohm)	Maximum Resistance (Ohm)	Nominal Resistance (Ohm)
78.5	9523	9715	9619
77.5	9650	9843	9746
76.5	10035	10236	10135
75.5	10282	10489	10385
33.5	30975	31598	31285
32.5	31871	32512	32190
31.5	32653	33310	32980
30.5	33728	34406	34065
1.5	80624	82244	81430
0.5	83327	85002	84160
0.0	84564	86264	85410

Chart 1: Thermistor Nominal Resistance

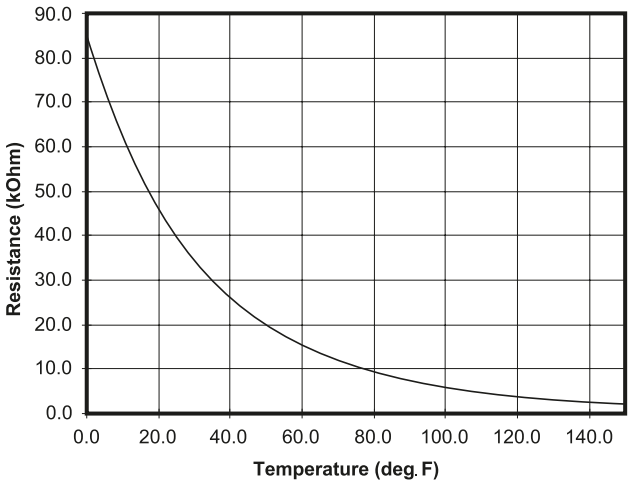


Table 3: Replacement Thermistor FP1, FP2 Part Numbers

Thermistor Type	Tube OD	Lead Length (in.)			
		36	48	96	192
FP1 (Gray)	3/8, 1/2	17B0027N06	N/A	17B0027N04	N/A
	5/8, 7/8	N/A	N/A	17B0026N01	N/A
FP2 (Violet)	3/8, 1/2	N/A	17B0026N02	N/A	17B0005N05
	5/8, 7/8	N/A	N/A	N/A	17B0026N02

Table 4: Nominal Resistance at Various Temperatures

Temp (°C)	Temp (°F)	Resistance (kOhm)	Temp (°C)	Temp (°F)	Resistance (kOhm)
-17.8	0.0	85.41	55	131.0	2.99
-17.5	0.5	84.16	56	132.8	2.88
-16.9	1.5	81.43	57	134.6	2.77
-12	10.4	61.70	58	136.4	2.67
-11	12.2	58.40	59	138.2	2.58
-10	14.0	55.30	60	140.0	2.49
-9	15.8	52.40	61	141.8	2.40
-8	17.6	49.60	62	143.6	2.32
-7	19.4	47.00	63	145.4	2.23
-6	21.2	44.60	64	147.2	2.16
-5	23.0	42.30	65	149.0	2.08
-4	24.8	40.10	66	150.8	2.01
-3	26.6	38.10	67	152.6	1.94
-2	28.4	36.10	68	154.4	1.88
-1	30.2	34.30	69	156.2	1.81
0	32.0	32.60	70	158.0	1.75
1	33.8	31.00	71	159.8	1.69
2	35.6	29.40	72	161.6	1.64
3	37.4	28.00	73	163.4	1.58
4	39.2	26.60	74	165.2	1.53
5	41.0	25.30	75	167.0	1.48
6	42.8	24.10	76	168.8	1.43
7	44.6	23.00	77	170.6	1.38
8	46.4	21.90	78	172.4	1.34
9	48.2	20.80	79	174.2	1.30
10	50.0	19.90	80	176.0	1.26
11	51.8	18.97	81	177.8	1.22
12	53.6	18.09	82	179.6	1.18
13	55.4	17.25	83	181.4	1.14
14	57.2	16.46	84	183.2	1.10
15	59.0	15.71	85	185.0	1.07
16	60.8	15.00	86	186.8	1.04
17	62.6	14.32	87	188.6	1.00
18	64.4	13.68	88	190.4	0.97
19	66.2	13.07	89	192.2	0.94
20	68.0	12.49	90	194.0	0.92
21	69.8	11.94	91	195.8	0.89
22	71.6	11.42	92	197.6	0.86
23	73.4	10.92	93	199.4	0.84
24	75.2	10.45	94	201.2	0.81
25	77.0	10.00	95	203.0	0.79
26	78.8	9.57	96	204.8	0.76
27	80.6	9.17	97	206.6	0.74
28	82.4	8.78	98	208.4	0.72
29	84.2	8.41	99	210.2	0.70
30	86.0	8.06	100	212.0	0.68
31	87.8	7.72	101	213.8	0.66
32	89.6	7.40	102	215.6	0.64
33	91.4	7.10	103	217.4	0.62
34	93.2	6.81	104	219.2	0.60
35	95.0	6.53	105	221.0	0.59
36	96.8	6.27	106	222.8	0.57
37	98.6	6.02	107	224.6	0.56
38	100.4	5.78	108	226.4	0.54
39	102.2	5.55	109	228.2	0.53
40	104.0	5.33	110	230.0	0.51
41	105.8	5.12	111	231.8	0.50
42	107.6	4.92	112	233.6	0.48
43	109.4	4.73	113	235.4	0.47
44	111.2	4.54	114	237.2	0.46
45	113.0	4.37	115	239.0	0.45
46	114.8	4.20	116	240.8	0.43
47	116.6	4.04	117	242.6	0.42
48	118.4	3.89	118	244.4	0.41
49	120.2	3.74	119	246.2	0.40
50	122.0	3.60	120	248.0	0.39
51	123.8	3.47	121	249.8	0.38
52	125.6	3.34	122	251.6	0.37
53	127.4	3.22	123	253.4	0.36
54	129.2	3.10			

CXM Thermostat Details

Thermostat Compatibility - Most all heat pump thermostats can be used with the CXM control. However Heat/Cool stats are NOT compatible with the CXM.

Anticipation Leakage Current - Maximum leakage current for "Y" is 50 mA and for "W" is 20mA. Triacs can be used if leakage current is less than above. Thermostats with anticipators can be used if anticipation current is less than that specified above.

Thermostat Signals

- "Y" and "W" have a 1 second recognition time when being activated or being removed.
- "O" and "G" are direct pass through signals but are monitored by the micro processor.
- "R" and "C" are from the transformer.
- "AL1" and "AL2" originate from the Alarm Relay.
- "A" is paralleled with the compressor output for use with well water solenoid valves.
- The "Y" 1/4" quick connect is a connection point to the "Y" input terminal P1 for factory use. This "Y" terminal can be used to drive panel mounted relays such as the loop pump relay.

Safety Listing

The CXM control is listed under the UL Standard for limit controls and is CE listed under EN50081-1 and EN61000-3.

Troubleshooting Information

General - CXM board troubleshooting in general is best summarized as simply verifying inputs and outputs. After this process has been verified, confidence in board operation is confirmed and the trouble must be elsewhere. Below are some general guidelines required for developing training materials and procedures when applying the CXM Control.

CXM Field Inputs - All inputs are 24VAC from the thermostat and can be verified using a Volt meter between C and Y, G, O, W. See the I/O reference table (table 5).

Sensor Inputs - All sensor inputs are 'paired wires' connecting each component with the board. Therefore continuity on pressure switches can be checked at the board connector.

The thermistor resistance should be measured with the connector removed so that only the impedance of the thermistor is measured. If desired this reading can be compared to the chart shown in the thermistor section of this manual based upon the actual temperature of the thermistor clip. An ice bath can be used to check calibration of a thermistor if needed.

CXM Outputs - The compressor relay is 24VAC and can be verified using a voltmeter. The fan signal is passed through the board to the external fan relay. The alarm relay can either be 24VAC as shipped or dry contacts (measure continuity during fault) for use with DDC by clipping the J1 jumper. Electric heat outputs are 24VDC and require a voltmeter set for DC to verify operation. When troubleshooting, measure from 24VDC terminal to EH1 or EH2 terminals. See the I/O reference table.

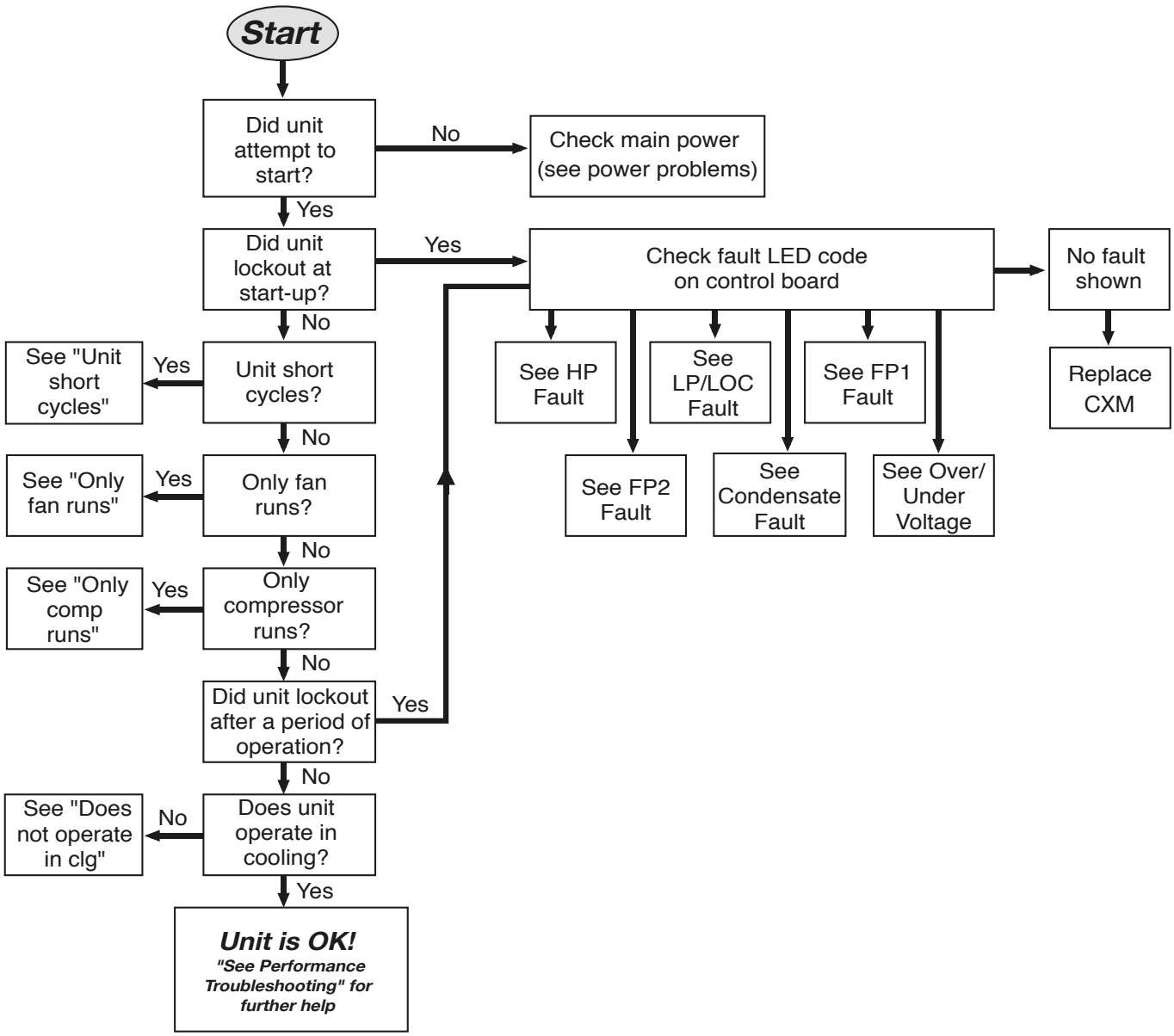
Test Mode - Test Mode can be entered for 20 minutes by shorting the test pins. For diagnostic ease at the thermostat, the alarm relay will also cycle during Test Mode. The alarm relay will cycle on and off similar to the fault LED to indicate a code representing the last fault, at the thermostat. Test Mode can also be entered and exited by cycling the G input, 3 times within a 60 second time period.

Table 5: CXM Input/Output Reference Table

Connection	Input or Output	Description
R	-	24 VAC
C	-	24 VAC (grounded common)
Y	I	Connect to thermostat - Y output call for compressor
W	I	Connect to thermostat - W output call for Htg2 or Emerg Ht
O	I	Connect to thermostat - 0 output call for reversing valve with cooling
G	I	Connect to thermostat - G output call for fan
AL1	O	Connect to thermostat fault light - 24VAC or dry alarm
AL2	O	Alarm Relay 24VAC or dry
A	O	Output for water solenoid valve - paralleled with compressor contactor coil
BR	O	Connection for blower relay-direct connect from G
BRG	O	Blower relay common connection
CC	O	Connection for compressor contactor
CCG	O	Compressor contactor common connection
HP	I	High Pressure Switch input terminals
LP	I	Low Pressure Switch input terminals
FP1	I	Water Coil Low Temperature Thermistor Input
FP2	I	Air Coil Low Temperature Thermistor Input
RV	O	Reversing Valve Output Terminals - direct connect from "O"
CO	I	Condensate overflow input terminals
24VDC	O	24 VDC supply to electric heat module
W1	O	Output terminal for stage 1 electric heat
W2	O	Output terminal for stage 2 electric heat

Troubleshooting Chart

Use the following troubleshooting flow chart to find appropriate troubleshooting strategies on the following pages for the CXM control and most water source heat pump applications.



CXM Unit Control

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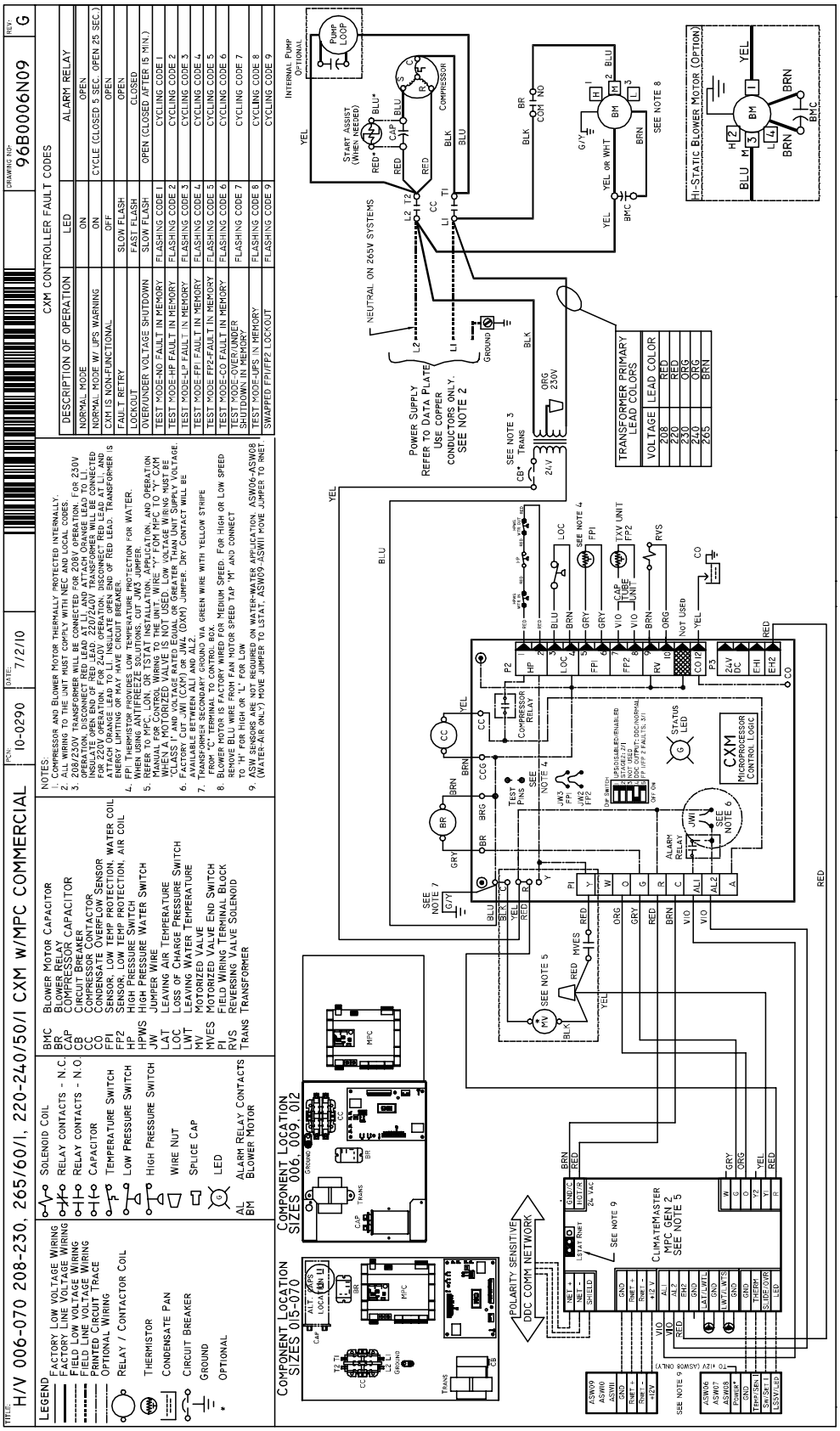
CXM Wiring Diagram


TITLE: H/V 006-070 208-230, 265/60/1, 220-240/50/1 CXM w/MPC COMMERCIAL
PCN: 10-0290
DATE: 7/2/10
DRAWING NO: 96B0006N09
REV: G
LEGEND
FACTORY LOW VOLTAGE WIRING
FACTORY LINE VOLTAGE WIRING
FIELD LOW VOLTAGE WIRING
FIELD LINE VOLTAGE WIRING
PRINTED CIRCUIT TRACE
OPTIONAL WIRING
RELAY / CONTACTOR COIL
THERMISTOR
CONDENSATE PAN
CIRCUIT BREAKER
GROUND
OPTIONAL
SOLENOID COIL
RELAY CONTACTS - N.C.
RELAY CONTACTS - N.O.
CAPACITOR
TEMPERATURE SWITCH
LOW PRESSURE SWITCH
HIGH PRESSURE SWITCH
WIRE NUT
SPLICE CAP
LED
ALARM RELAY CONTACTS
BLOWER MOTOR
BLOWER MOTOR CAPACITOR
BLOWER RELAY
COMPRESSOR CAPACITOR
CIRCUIT BREAKER
COMPRESSOR CONTACTOR
CONDENSATE OVERFLOW SENSOR
SENSOR, LOW TEMP PROTECTION, WATER COIL
SENSOR, LOW TEMP PROTECTION, AIR COIL
HIGH PRESSURE SWITCH
HIGH PRESSURE WATER SWITCH
JUMPER WIRE
LEAVING AIR TEMPERATURE
LOSS OF CHARGE PRESSURE SWITCH
LEAVING WATER TEMPERATURE
MOTORIZED VALVE
MOTORIZED VALVE END SWITCH
FIELD WIRING TERMINAL BLOCK
REVERSING VALVE SOLENOID
TRANSFORMER
NOTES:
1. COMPRESSOR AND BLOWER MOTOR THERMALLY PROTECTED INTERNALLY.
2. ALL WIRING TO THE UNIT MUST COMPLY WITH NEC AND LOCAL CODES
3. 208/230V TRANSFORMER WILL BE CONNECTED FOR 208V OPERATION. FOR 230V OPERATION, DISCONNECT BLUE WIRE AT 208V TAP AND CONNECT TO 230V TAP. INSULATE OPEN END OF RED LEAD. 220/240V TRANSFORMER WILL BE CONNECTED FOR 220V OPERATION. FOR 240V OPERATION, DISCONNECT RED LEAD AT L1, AND CONNECT ORANGE LEAD IN ITS PLACE. INSULATE OPEN END OF RED LEAD. TRANSFORMER IS ENERGY LIMITING OR MAY HAVE CIRCUIT BREAKERS.
4. FP1 THERMISTOR PROVIDES LOW TEMPERATURE PROTECTION FOR WATER. WHEN USING ANTIFREEZE SOLUTIONS, CUT JW3 JUMPER.
5. REFER TO MPC, LON OR ISTAT INSTALLATION, APPLICATION, AND OPERATION MANUALS FOR CONFIGURATION AND WIRING TO THESE UNIT CONTROLLERS TO CXM.
6. FACTORY CUT JW1 (CXM) OR JW2 (DXM) JUMPER. DRY CONTACT WILL BE ENERGIZED WHEN BLOWER IS ON.
7. TRANSFORMER SECONDARY GROUND VIA GREEN WIRE WITH YELLOW STRIPE FROM "C" TERMINAL TO CONTROL BOX.
8. BLOWER MOTOR IS FACTORY WIRED FOR MEDIUM SPEED. FOR HIGH OR LOW SPEED REMOVE BLU WIRE FROM FAN MOTOR SPEED TAP "M" AND CONNECT TO "H" FOR HIGH OR "L" FOR LOW
9. ASWP01 POWER SUPPLY REQUIRED ON WATER-WATER APPLICATION. ASW06-ASW08 (WATER-AIR ONLY) MOVE JUMPER TO ISTAT. ASW09-ASW11 MOVE JUMPER TO INET
CXM CONTROLLER FAULT CODES
DESCRIPTION OF OPERATION | LED | ALARM RELAY
NORMAL MODE | ON | OPEN
NORMAL MODE W/ UPS WARNING | ON | CYCLE (CLOSED 5 SEC. OPEN 25 SEC.)
CXM IS NON-FUNCTIONAL | OFF | OPEN
FAULT RETRY | SLOW FLASH | OPEN
LOCKOUT | FAST FLASH | CLOSED
OVER/UNDER VOLTAGE SHUTDOWN | SLOW FLASH | OPEN (CLOSED AFTER 15 MIN.)
TEST MODE-NO FAULT IN MEMORY | FLASHING CODE 1 | CYCLING CODE 1
TEST MODE-HP FAULT IN MEMORY | FLASHING CODE 2 | CYCLING CODE 2
TEST MODE-LP FAULT IN MEMORY | FLASHING CODE 3 | CYCLING CODE 3
TEST MODE-FP1 FAULT IN MEMORY | FLASHING CODE 4 | CYCLING CODE 4
TEST MODE-FP2-FAULT IN MEMORY | FLASHING CODE 5 | CYCLING CODE 5
TEST MODE-CO FAULT IN MEMORY | FLASHING CODE 6 | CYCLING CODE 6
TEST MODE-OVER/UNDER SHUTDOWN IN MEMORY | FLASHING CODE 7 | CYCLING CODE 7
TEST MODE-UPS IN MEMORY | FLASHING CODE 8 | CYCLING CODE 8
SWAPPED FP1/FP2 LOCKOUT | FLASHING CODE 9 | CYCLING CODE 9
COMPONENT LOCATION SIZES 006, 009, 012
COMPONENT LOCATION SIZES 015-070
POLARITY SENSITIVE DDC COMM NETWORK
CLIMATEMASTER MPC GEN 2 SEE NOTE 5
CXM MICROPROCESSOR CONTROL LOGIC
STATUS LED
ALARM RELAY 1 AMP MAX
TXV UNIT FP2
CAP TUBE UNIT
INTERNAL PUMP (OPTIONAL)
PUMP LOOP
START ASSIST (WHEN NEEDED)
COMPRESSOR
POWER SUPPLY REFER TO DATA PLATE USE COPPER CONDUCTORS ONLY. SEE NOTE 2
NEUTRAL ON 265V SYSTEMS
GROUND
SEE NOTE 3 TRANS
24V
ORG 230V
TRANSFORMER PRIMARY LEAD COLORS
VOLTAGE | LEAD COLOR
208 | RED
220 | RED
230 | ORG
240 | ORG
265 | BRN
HI-STATIC BLOWER MOTOR (OPTION)
SEE NOTE 8
SEE NOTE 4
SEE NOTE 6
SEE NOTE 7
SEE NOTE 9
TO 12V (ASW06 ONLY)

Functional Troubleshooting

⚠ CAUTION! ⚠

CAUTION! Do not restart units without inspection and remedy of faulting condition. Equipment damage may occur.

Fault	Htg	Clg	Possible Cause	Solution
Main power problems	X	X	Green Status LED Off	Check line voltage circuit breaker and disconnect.
				Check for line voltage between L1 and L2 on the contactor.
				Check for 24VAC between R and C on CXM/DXM'
				Check primary/secondary voltage on transformer.
HP Fault Code 2 **High Pressure**		X	Reduced or no water flow in cooling	Check pump operation or valve operation/setting.
				Check water flow adjust to proper flow rate.
		X	Water Temperature out of range in cooling	Bring water temp within design parameters.
	X		Reduced or no air flow in heating	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Dirty Air Coil- construction dust etc.
				Too high of external static. Check static vs blower table.
	X		Air temperature out of range in heating	Bring return air temp within design parameters.
	X	X	Overcharged with refrigerant	Check superheat/subcooling vs typical operating condition table.
	X	X	Bad HP Switch	Check switch continuity and operation. Replace.
LP/LOC Fault Code 3 **Low Pressure / Loss of Charge**	X	X	Insufficient charge	Check for refrigerant leaks
	X		Compressor pump down at start-up	Check charge and start-up water flow.
LT1 Fault Code 4 **Water coil low temperature limit**	X		Reduced or no water flow in heating	Check pump operation or water valve operation/setting.
				Plugged strainer or filter. Clean or replace..
				Check water flow adjust to proper flow rate.
	X		Inadequate antifreeze level	Check antifreeze density with hydrometer.
	X		Improper temperature limit setting (30°F vs 10°F [-1°C vs -2°C])	Clip JW3 jumper for antifreeze (10°F [-12°C]) use.
	X		Water Temperature out of range	Bring water temp within design parameters.
	X	X	Bad thermistor	Check temp and impedance correlation per chart
LT2 Fault Code 5 **Air coil low temperature limit**		X	Reduced or no air flow in cooling	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Too high of external static. Check static vs blower table.
		X	Air Temperature out of range	Too much cold vent air? Bring entering air temp within design parameters.
		X	Improper temperature limit setting (30°F vs 10°F [-1°C vs -12°C])	Normal airside applications will require 30°F [-1°C] only.
	X	X	Bad thermistor	Check temp and impedance correlation per chart.
Condensate Fault Code 6	X	X	Blocked drain	Check for blockage and clean drain.
	X	X	Improper trap	Check trap dimensions and location ahead of vent.
		X	Poor drainage	Check for piping slope away from unit.
				Check slope of unit toward outlet.
				Poor venting. Check vent location.
		X	Moisture on sensor	Check for moisture shorting to air coil.
	X	X	Plugged air filter	Replace air filter.
	x	X	Restricted Return Air Flow	Find and eliminate restriction. Increase return duct and/or grille size.
Over/Under Voltage Code 7 **(Auto resetting)**	X	X	Under Voltage	Check power supply and 24VAC voltage before and during operation.
				Check power supply wire size.
				Check compressor starting. Need hard start kit?
				Check 24VAC and unit transformer tap for correct power supply voltage.
	X	X	Over Voltage	Check power supply voltage and 24VAC before and during operation.
				Check 24VAC and unit transformer tap for correct power supply voltage.
Unit Performance Sentinel Code 8	X		Heating mode FP2>125°F [52°C]	Check for poor air flow or overcharged unit.
		X	Cooling Mode FP1>125°F [52°C] OR FP2< 40ºF [4ºC])	Check for poor water flow, or air flow.
No Fault Code Shown	X	X	No compressor operation	See "Only Fan Operates".
	X	X	Compressor overload	Check and replace if necessary.
	X	X	Control board	Reset power and check operation.

Table Continued on Next Page

CXM Unit Control

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Fault	Htg	Clg	Possible Cause	Solution
Unit Short Cycles	X	X	Dirty air filter	Check and clean air filter.
	X	X	Unit in "test mode"	Reset power or wait 20 minutes for auto exit.
	X	X	Unit selection	Unit may be oversized for space. Check sizing for actual load of space.
	X	X	Compressor overload	Check and replace if necessary
Only Fan Runs	X	X	Thermostat position	Ensure thermostat set for heating or cooling operation.
	X	X	Unit locked out	Check for lockout codes. Reset power.
	X	X	Compressor Overload	Check compressor overload. Replace if necessary.
	X	X	Thermostat wiring	Check thermostat wiring at heat pump. Jumper Y and R for compressor operation in test mode.
Only Compressor Runs	X	X	Thermostat wiring	Check G wiring at heat pump. Jumper G and R for fan operation
	X	X	Fan motor relay	Jumper G and R for fan operation. Check for Line voltage across BR contacts.
	X	X		Check fan power enable relay operation (if present).
	X	X	Fan motor	Check for line voltage at motor. Check capacitor.
	X	X	Thermostat wiring	Check thermostat wiring at heat pump. Jumper Y and R for compressor operation in test mode
Unit Doesn't Operate in Cooling		X	Reversing valve	Set for cooling demand and check 24VAC on RV coil and at CXM/DXM board.
				If RV is stuck, run high pressure up by reducing water flow and while operating engage and disengage RV coil voltage to push valve.
		X	Thermostat setup	Check for 'O' RV setup not 'B'.
		X	Thermostat wiring	Check O wiring at heat pump. Jumper O and R for RV coil 'click'.
		X	Thermostat wiring	Put thermostat in cooling mode. Check 24 VAC on O (check between C and O); check for 24 VAC on W (check between W and C). There should be voltage on O, but not on W. If voltage is present on W, thermostat may be bad or wired incorrectly.

Performance Troubleshooting

Performance Troubleshooting	Htg	Clg	Possible Cause	Solution
Insufficient capacity/ Not cooling or heating	X	X	Dirty filter	Replace or clean.
	X		Reduced or no air flow in heating	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Too high of external static. Check static vs. blower table.
		X	Reduced or no air flow in cooling	Check for dirty air filter and clean or replace.
				Check fan motor operation and airflow restrictions.
				Too high of external static. Check static vs. blower table.
	X	X	Leaky duct work	Check supply and return air temperatures at the unit and at distant duct registers if significantly different, duct leaks are present.
	X	X	Low refrigerant charge	Check superheat and subcooling per chart.
	X	X	Restricted metering device	Check superheat and subcooling per chart. Replace.
		X	Defective reversing valve	Perform RV touch test.
	X	X	Thermostat improperly located	Check location and for air drafts behind stat.
	X	X	Unit undersized	Recheck loads & sizing. Check sensible clg. load and heat pump capacity.
	X	X	Scaling in water heat exchanger	Perform scaling check and clean if necessary.
	X	X	Inlet water too hot or too cold	Check load, loop sizing, loop backfill, ground moisture.
High Head Pressure	X		Reduced or no air flow in heating	Check for dirty air filter and clean or replace.
				Check fan motor operation and air flow restrictions.
				Too high of external static. Check static vs. blower table.
		X	Reduced or no water flow in cooling	Check pump operation or valve operation/setting.
				Check water flow. Adjust to proper flow rate.
		X	Inlet water too hot	Check load, loop sizing, loop backfill, ground moisture.
	X		Air temperature out of range in heating	Bring return air temperature within design parameters.
		X	Scaling in water heat exchanger	Perform scaling check and clean if necessary.
	X	X	Unit overcharged	Check superheat and subcooling. Re-weigh in charge.
	X	X	Non-condensables in system	Vacuum system and re-weigh in charge.
	X	X	Restricted metering device.	Check superheat and subcooling per chart. Replace.
Low Suction Pressure	X		Reduced water flow in heating.	Check pump operation or water valve operation/setting.
				Plugged strainer or filter. Clean or replace.
				Check water flow. Adjust to proper flow rate.
	X		Water temperature out of range.	Bring water temperature within design parameters.
		X	Reduced air flow in cooling.	Check for dirty air filter and clean or replace.
				Check fan motor operation and air flow restrictions.
				Too high of external static. Check static vs. blower table.
		X	Air temperature out of range	Too much cold vent air? Bring entering air temperature within design parameters.
	X	X	Insufficient charge	Check for refrigerant leaks.
Low Discharge Air Temperature in Heating	X		Too high of air flow	Check fan motor speed selection and air flow chart.
	X		Poor performance	See 'Insufficient Capacity'
High humidity		X	Too high of air flow	Check fan motor speed selection and airflow chart.
		X	Unit oversized	Recheck loads & sizing. Check sensible clg load and heat pump capacity.

Notes:

Notes:

Revision History

Date:	Item:	Action:
01/03/11	Format - All Pages	Updated
06/11/10	Format - All Pages	Updated
06/11/10	CXM Physical Dimensions & Layout	Illustration Updated
10/30/09	Functional Troubleshooting Table	Updated
04/29/09	CXM Physical Dimensions & Layout	FP1 and FP2 Information Corrected
01/5/09	First Published	

97B0003N12

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